

SHMS-HMS Users Group Newsletter

January 2013

Newsletter edited by: Stephen Wood

Contents

Hall C Users Meeting.....	1
SHMS-HMS User's Board.....	1
SHMS Project Update (Howard Fenker)	3
Progress on SHMS software (Mark Jones)	4
Status of Hall C (Steve Wood)	4
Status of the SHMS Nobel Gas Cerenkov detector (Donal Day)	5
Useful Weblinks	6

Hall C Users Meeting

The next Hall C users meeting will be January 24 and 25, 2013. The agenda is posted at http://www.jlab.org/Hall-C/talks/01_24_13/.

SHMS-HMS User's Board

The SHMS-HMS User's Board holds regular phone meetings to discuss status and progress of the 12 GeV Upgrade in Hall C, in particular the SHMS as well as physics and other matters associated with Hall C at 12 GeV.

In September, an election was held by email, to select new members of the SHMS-HMS User's Board. Kawtar Hafidi and Gabriel Niculescu were elected to replace outgoing board members Tanja Horn and John Arrington.

The last meeting of the 2011/2012 Board was on December 7, 2012. The main topic of the meeting was a proposal to rename the SHMS-HMS User's group to the "Hall C Users Group".

Members of the Board: Gabriel Niculescu (gabriel@jlab.org), Donal Day (dbd@virginia.edu), Kawtar Hafidi (hafidi@jlab.org), Mark Jones(jones@jlab.org), Eric Christy (christy@jlab.org) and Pete Markowitz (markowit@fiu.edu)

As a reminder the detector team is:

Contact	Institution	Current Project
Howard Fenker	JLab, Hall C	12 GeV Assistant Project Manager
Donal Day	University of Virginia	Noble Gas Cerenkov
Dipangkar Dutta	Mississippi State University	Collimator
Tanja Horn	Catholic University of America	Aerogel Cerenkov
Garth Huber	University of Regina	Heavy Gas Cerenkov
Hamlet Mkrtchyan	NSL (Yerevan)	Calorimeter
Eric Christy Peter Monaghan	Hampton University	Drift Chambers
Ioana Niculescu	James Madison University	Scintillator Hodoscopes
Charles Perdrisat	College of William and Mary	Support Structure
Abdellah Amidouch Sam Danagoulian	North Carolina A&T	Quartz Hodoscope
Brad Sawatzky	JLab, Hall C	DAQ, Gas system
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SHMS Project Update (Howard Fenker)

The detectors for the SHMS are all moving along nicely and are expected to be tested, in storage, and ready for installation by about August, 2013. All of the scintillator and quartz hodoscope paddles are complete. JMU students have been performing cosmic-ray testing of the scintillator paddles for the S1X, S1Y, and S2X hodoscopes. This involves taking three hours of data at each of five positions along the paddle at four different high-voltage settings. Similar studies on the quartz (S2Y) hodoscope are taking place at NCA&T. Both groups are about half-way through the testing process. The new CAEN positive high-voltage system has been delivered and a portion of it will be used to accelerate the S2Y tests. Other electronics, including the F-250 ADC's, have been delivered as well. The first half-module of the drift chamber system has been assembled at HU, is holding gas, and is being conditioned at increasing high-voltage settings. The production mirrors for the Heavy-Gas Cerenkov just underwent final reflectivity measurements (they met specifications), and the 2-meter diameter tank for this detector is nearing completion. Final-design drawings for the Noble-Gas Cerenkov (NGC) are within hours of being completed. This design will be presented at the January Hall-C collaboration meeting. UVa has made some nice measurements of the improvement in PMT short-wavelength detection efficiency provided by overcoating the tubes, and expects to select and order the final PMTs for the NGC in the next few weeks.

All structural parts for the SHMS carriage are on site. The wheels and bogies are still at the factory undergoing final alignment. A contract has been signed for installation of the rails, and installation has started. Bids are coming in for assembly of the carriage, and a request-for-proposal is being issued for the shield-house concrete work. Much of the special shielding material (B4C, Pb, and plastic granules) has been delivered. A large shipment of built-to-order cryogenic plumbing has just arrived, and the first two of the five magnet power supplies are currently en-route to Newport News.

While the superconducting magnets all remain behind schedule, the HB and Q1 magnets have seen good progress recently. Delivery of Q1 is now expected in February, 2014, with HB to follow in May. Technical issues related to coil fabrication for the dipole and Q2/Q3 are receiving intense study by both JLab and the vendor. Installation of the final quad will clearly drive the completion date for the SHMS. First beam in Hall-C is planned for July, 2015.

Progress on SHMS software (Mark Jones)

Progress on the Hall C ROOT/C++ analyzer (HCANA) is moving along. Simon Zhamkochyan is working on the HMS shower code. Gabriel Niculescu and a student are working on the HMS scintillator software. We need volunteers to start using the code and give feedback. One can find out about the code at https://hallcweb.jlab.org/wiki/index.php/ROOT_Analyzer which has links to obtaining HCANA from the git repository, then compiling it and running the code.

In November, a meeting of the hall's software management was held to discuss the 12 GeV Software Review report (<https://hallcweb.jlab.org/wiki/images/1/1d/JLab12GeVSoftwareComputingReviewFinal20120912.pdf>) and progress on meeting their recommendations. The Hall C presentation is at https://hallcweb.jlab.org/wiki/images/7/72/HallC_software_meeting_nov5_2012.pdf. The next 12 GeV Software review will most likely be held in September 2013.

A joint Hall A/C analysis workshop was held on December 13th. the agenda and links to talks are at http://hallaweb.jlab.org/data_reduc/AnaWork2012/. Gabriel Niculescu gave an overview talk on HCANA and Mark Jones gave an introduction to the git version control software.

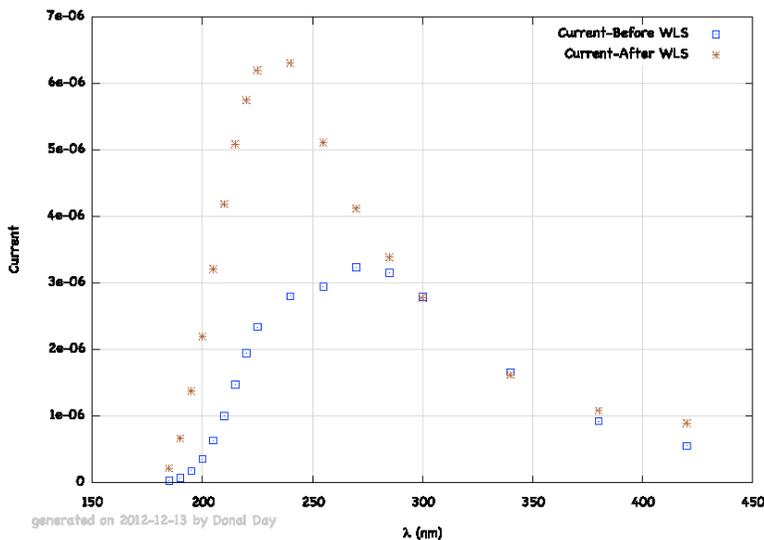
To follow software development, subscribe to the "hallcsw" and look at the wiki page <https://hallcweb.jlab.org/wiki/index.php/Analyzer>. Phone meetings, which are announced on the "hallcsw" mailing list, are held on Tuesdays every two weeks to discuss the software work. Agendas are posted on the Hall C wiki at https://hallcweb.jlab.org/wiki/index.php/Agendas_for_12GeV_software_meetings.

Status of Hall C (Steve Wood)

The Hall C technical group is nearing completion of work to prepare the Hall for the installation of the SHMS rails and the SHMS support structure. The raised concrete floor which was built to support the hypernuclear experiments has been completely removed. Work on removing the SOS spectrometer is progressing. The dipole was removed from the SOS carriage and taken out of the hall and work on cutting the shield house has started. All materials not supporting the concrete shield house has been cut off of the structure. (Stairs, walkway, shield house doors, electronics hut, ...) The SOS rails and rail beds are being removed, which will simplify installation of 3rd arm detectors. The removal of the SOS is scheduled to finish in February 2013 with the help of contractors to cut up the shield house and support frame. Installation of the SHMS carriage rails has started.

Status of the SHMS Nobel Gas Cerenkov detector (Donal Day)

The SHMS atmospheric Nobel Gas Cerenkov (NGC) is intended to provide good pion rejection between 6 and 11 GeV. For a pion threshold of 6 GeV it will be filled with argon -- a 11 GeV threshold demands a pure neon atmosphere while a mixture of the two will be used for intermediate thresholds. The total active length of the NGC is just 2.2m and the number of photoelectrons is at a premium. The number of cerenkov photons goes as $1/\lambda^2$ yet most pmts have very poor responses at small wavelength (below 200 nm). Quartz tubes provide a longer reach into the UV at the expense, usually, of a significantly greater cost.



We have studied the performance of a Hammamastu R1584 UV glass photomultiplier, in order to determine the benefit associated with the application of a thin layer of a wavelength shifter (WLS). The R1584 is a popular 5-inch 14-stage tube with a finite photocathode quantum efficiency (QE) between 185 to 650 nm. The QE

peaks (typically) at 22% near 350nm.

Using a deuterium lamp and a monochromator connected to a bifurcated fiber we measured the response of a test R1584 along with a reference PMT (also a R1584) as a function of wavelength. The setup is fairly simple. We irradiated the glass surface of the PMTs and measured the current with an HP multimeter. Care was taken to keep the current small and to insure the reproducibility of the results. The test PMT was sent to the Thin Film Coatings facility at Fermilab where it was coated with p-terphenyl (approximately 20 k-angstroms). The p-terphenyl absorbs all light in the wavelength range from 110 nm to 360 nm; within 1 to 2 ns, on average, it de-excites with 74% efficiency by fluorescence in a narrow band centered on $\lambda = 385$ nm, precisely where many PMTs (including the R1584) are most sensitive.

Upon the return of the test PMT from Fermilab it was put back into our setup and its response measured. The dramatic effect of the WLS can be seen in the figure where the current before and after the WLS application is shown.

Analytical expressions exist to calculate the total number of Cerenkov photoelectrons under specified conditions (index of gas, reflectivity of mirrors, absorption in the gas, QE, etc. Taking the assumption that we can multiply the tabulated QE of the R1584 by the ratio of the currents seen in the figure, we find that application of the WLS should increase the number of photoelectrons by 50%, in line with previous work by others. We will soon have a quartz tube from Electron Tubes (9823QB) and will measure its response as a function of wavelength and should be able to determine which of our two candidate tubes, the Hammamatsu R1584 or the ET 9823QB, to select for the SHMS NGC, taking the total number of photoelectrons as the basis.

Useful Weblinks

- Hall C Publications: <https://hallcweb.jlab.org/publications/>
- Hall C Ph.D. Theses: http://www1.jlab.org/ul/generic_reports/thesis.cfm
- Hall C Home Page: <http://www.jlab.org/Hall-C/>
- Hall C Wiki: <https://hallcweb.jlab.org/wiki/>
- Hall C 12 GeV Upgrade: <http://www.jlab.org/Hall-C/upgrade/>
- Weekly Meeting Minutes: https://hallcweb.jlab.org/wiki/index.php/Hall_C_Weekly_Meeting
- Previous Newsletters: https://hallcweb.jlab.org/wiki/index.php/Newsletter_Listing_for_SHMS/HMS
- SHMS-HMS Users Group: http://www.jlab.org/Hall-C/upgrade/shms_users_group.html
- Conference listing page: <http://cnr2.kent.edu/~manley/BRAGmeetings.html>